ON THE NEED OF

SANSKRIT

I. Neglect to Sanskrit-education.

II. Importance of Sanskritic Studies :

A. Importance in the Fields of Humanities and Social Sciences.

B. Importance in the Fields of Natural, Pure and Exact Sciences

by

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★ सूर्य आत्मा जगतस्तस्थूषश्च— *Rg-Veda,*

The sun is the soul of the mobile and of the stable.

★ अन्तःसंज्ञा भवन्त्येते सुखदुःखसमन्विताः— *Manu-Samhitā.*

These (plants) have consciousness or feeling within and are endowed with happiness and misery.

★ नभो वितिमिरं कुर्वन् जलदान् पाटयन्निव ।
दिशः सम्पूरयन् नादै र्महामेघरवोपमैः ॥ —*Mahābhārata.*

Having made the sky free from darkness, having torn the clouds as it were, and having filled the directions by sounds comparable to the sounds of big clouds (the air-craft appeared).

★ छादको भास्करस्येन्दुरधःस्थो घनवद् भवेत्— *Sūrya-Siddhānta*

(In solar eclipse), the moon lying at the lower orbit of the sun envelops it, like a cloud.

★ भूच्छायां स्वग्रहणे भास्करमर्कग्रहे प्रविशतीन्दुः— *Bṛhat-Saṁhitā* of Varāhamihira

In lunar eclipse, the moon enters into the shade of the earth, and in solar elcipse, it (the moon) enters into the body of the sun.

★ लङ्कापुरेऽर्कस्य यदोदयः स्यात् तदा दिनार्धं यमकोटिपुर्याम् ।
अधस्तदा सिद्धपुरेऽस्तकालः स्याद् रोमके रात्रिदलं तदैव ॥
—*Siddhānta-śiromaṇi* of Bhāskara

When the sun rises in Laṅkāpura (in Bharata), it is mid-day in Yamakoṭipura, sun-set in Siddhapura (lower region) and mid-night in Romaka.

★ आकृष्यते तत् पततीव भाति— *Ibid.*

(A thing) that is attracted (by the earth) seems to be falling (to the ground).

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1. NEGLECT TO SANSKRIT-EDUCATION

While speaking about the aim of our nation today, our leaders very often speak of political freedom, economic freedom and so on, but they never speak of psychological freedom which in our view is the prerequisite of a free nation. If one ponders a little over our neglect to Sanskritic and Indological studies in the educational curriculum, one will find how we still lack the power to think of our own cause with an independent outlook. While announcing the educational policy, the Govt. at times declares with high-sounding words that proper steps will be taken for the nourishment of Sanskritic and Indological studies, but those announcements never come to reality.

Most of our social and political leaders think that Sanskrit —like Hindi, English etc.—is simply a subject of ornamental literature consisting of some sweet sounding *Ślokas* concerning beauty, love and morality. But it is a serious mistake ; Sanskrit is a subject not simply dealing with some themes of love, beauty or morality, but encompassing all the branches of study prevalent in ancient India. It includes different branches of humanities like linguistics, rhetorics, grammar, music, dance, philosophy, logic, ethics, economics, political science etc. and also those of science, such as astronomy, mathematics, botany, biology, medical science, physics, chemistry, warfare etc. Sanskrit is, therefore, a subject which represents the whole of India's past. The Vedic civilisation of India flourished before the 4000 B.C., and since then this country was on march for centuries. During

this period, there were born hundreds of sages who contributed to almost all the branches of study. The ancient India is such a wonder to human civilisation that the more one goes deep into its achievements, the more one becomes astonished to find the intensive and varied studies of the sages of that remote antiquity. And all the contributions of these ancient sages have been contained in Sanskrit literature. An evaluation of the varied studies of ancient India reveals, to speak in a few sentences, the following facts : (1) The study of linguistics began in India before the 8th century B.C. when people of other countries could not even dream of it. (2) Philosophical studies in India were far greater and deeper than those of all other countries of the world. (3) The sciences of arithmetic and geometry grew in India at least before the 1000 B.C., the system of arithmetic of that dim antiquity being in some cases at par with that of today. (4) Algebra flourished in India during the beginning of the Christian era. (5) The science of mathematics was learnt by the Arabians from India towards the 10th century A.D. and was later propagated by them in Europe. (6) The method of astronomical calculations prevalent in India before the 3000 B.C. till now gives us correct informations about astronomical events, (7) At least before the 6th or the 7th century B.C., and probably before the 3000 B.C., Indian sages discovered that plants are endowed with life. (8) The Medical Science fully developed in India before the 6th century B.C., and the practice of surgery was known to the physicians of that time. (9) From centuries before the Buddha, Yoga was practised by the Indian sages who acquired unthinkable powers by those practices. (10) The science

of making air-planes was most probably known to the ancient Indians, as can be imagined from some descriptions found in the great epics and also from the work *Vaimānikaśāstra*. (11) Some sorts of atomic missile were probably used by the Indian warriors during the wars described in the *Rāmāyaṇa* and the *Mahābhārata* i. e. before the 3000 B. C. *

All the above informations are found recorded in Sanskrit literature, and, hence, to know India's past, the knowledge of Sanskrit is indispensable. It is necessary not merely for knowing our past but also for finding out materials helpful to the advancement of modern civilisation and also for highlighting them to the world abroad.

It is a matter of great regret that we always think our ancient India to be a land of superstitions and bereft of scientific outlook. But when some Western thinker discovers some truths in our *śāstras*, we feel proud of our heritage. We acclaim a Western scholar when he says that the *Upaniṣads* and the *Gītā* are excellent works, or that Āyurveda and Yoga are medical systems of high standard. And, again, when some scientific truth or invention corroborates some theory or idea of our ancient sages, we feel elated. Until some Westerner appreciates our *śāstras* as containing some truths, or some Western theory comes in their corroboration, we always look down upon them.

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* For details, please see the next article : Importance of Sanskritic studies.

But how long will this base mentality continue ? Should we always look towards the West for the appraisal of our heritage ? Can we not make an independent assessment of the views or theories recorded in our ancient literature ? It cannot be said that modern India has no scientific thinking. Our people have been made to forget their identity only because of the defects in our educational policy. The policy-makers of Indian education are in most cases born and brought up in Western atmosphere and have no touch with the soil of India. They are busy to make a show of Westernism in making their policies of education. The result is that our learners do not get any facility to be acquainted with our heritage. The National Policy on Education, 1986, expresses its fear that 'a new generation having no roots in India's history and culture will appear in the scene' (4.7) and feels the need 'to sustain and carry forward the cultural tradition'. (4.9). But this policy does not seem to have the idea that if we are to have a generation having roots in India's history and culture, and if we are to sustain and carry forward an 'integral' cultural tradition, Sanskrit-education is a must. For the whole of India's culture coming down from the dim antiquity of five or six thousand B.C. is contained in Sanskrit works. Of course, this policy seeks 'to establish linkage between the University system' and the 'oriental studies' (4.10). But it does not propose any concrete step for this purpose. If the policy-makers give proper thoughts, they will realise that this can be done only through the propagation of Sanskrit-education.

We are thankful to the British rulers who did tremendous

service to the cause of Sanskritic study. During the British regime, Sanskrit was a compulsory subject in the secondary stage of education and much was done for the nourishment of the subject. After independence, stress on Sanskritic study began to decrease day by day, and now the subject has been thrown out from the educational curriculum by most of the non-Hindi states of India. It has now been made an optional subject, and the curriculum has been prepared in such a way that the students can easily avoid the subject. In many institutions, the subject has not been opened. Even in those institutions where Sanskrit is there, the students are discouraged to study the subject. As a result of this pitiable condition of Sanskrit in the secondary stage, the subject is in its last breath in the higher stage of education.

It is curious to note that the National Policy, under the head 'Higher Education' seems to realise the importance of 'research in Indology' (5-43) and of 'the development of facilities for the study of Sanskrit' (5-43). This reminds us of the proverb of 'watering a plant on the leaves instead of watering it on the roots'. Can any person convince us how a person who has not acquired the basic knowledge of Sanskrit in the secondary stage can carry on 'proper' research in Indology in the higher stage of education ? Again, can any sane person show how 'facilities for the study of Sanskrit' can be provided in higher education if the subject finds no place in secondary education ? The above-mentioned propositions of the National Policy, therefore, seem to be meant only to appease some plain-minded people. If the policy-makers were really serious in what they say about Sanskritic studies, they would have surely introduced the language

in the secondary stage of education. But the policy-makers have no such outlook. As a result, the language is going to die day by day. Foreign Indologists express great pains to see this pitiable condition of Sanskrit and blame the policy-makers, but our policy-makers care little for these remarks.

We, are, however, hopeful that our policy-makers will turn their eyes, today or tomorrow, towards the soil of India. The first requirement in this connection for our leaders and policy-makers is a change in our outlook—a change from 'blind disrespect to our heritage' to 'rational inquisitiveness and self-respect'. We should definitely learn the modern subjects of the West, but for that, we should not be negligent to our own past. We must remember that our ancient India was much higher in all respects than any other country of the then world, and should be sincere to find out the truths discovered by our ancient sages and contained in the vast treasure of Sanskrit literature. Our curriculum should be prepared in such a way that our learners can find scope to enter into the thoughts of our ancient sages, to reveal all the truths contained in our ancient works and thereby to give more light to human civilisation.

And for this, we require two things :

First, Sanskrit should be made a compulsory subject of study at the secondary stage of education. [For practical purposes, however, it may be made alternative to other classical languages.]

Secondly, in all the subjects of higher education, the corresponding Indic studies should be introduced in original Sanskrit. For this second purpose, subject-wise collections of original Sanskrit pieces should be prepared with necessary trans-

lat'ons and annotations. And the Govt. should take necessary steps for preparing these collections with the help of Sanskrit scholars. The said Indic studies should be introduced not only in the subjects coming under humanities but also in those of science and technology. In the medical science also the study of Ayurveda and Yoga in original Sanskrit should be made compulsory.

The need for Sanskr.tic studies should be considered from the view-point of national integration also. Sanskrit is the symbol of the unity of Indian nation. For this is the only language prevalent in every corner of the country — from Kashmir to Rameśvaram and from Punjab to Manipur and is accepted with reverence by all the people in general. The argument that Sanskrit is a religious language is ill-motivated and futile like saying that Arabic and English are religious languages because the Quoran and the Bible (as is presented to us) are written in these languages, respectively. The fear that Sanskrit is very difficult has no ground. Sanskr.t is simple like if not simpler than—any other modern language. To advance some pieces from Bāṇabhaṭṭa or Daṇḍin to prove Sanskrit to be a difficult language would be like proving English to be a difficult language by advancing some passages from *Paradise Lost*.

It may be added that the language problem of India could be solved by adopting Sanskrit as the lingua-franca. Historians will agree that Sanskrit was not only the national language of India but also the international language in most of the countries of Asia for several hundred years. We are confident that Sanskrit may even now be adopted as the lingua-franca. If our leaders

hesitate to do so a language may be developed with Sanskrit words and roots commonly used in most of the current languages of India and by adopting some declensional and conjugational forms from them.

We hope, the policy-makers and the authorities in the helm of affairs will pay due considerations to our proposals for the nourishment of Sanskritic studies in order to develop an integrated nation — intellectually and emotionally self-confident

11. IMPORTANCE OF SANSKRITIC STUDIES

A. Importance in the Fields of Humanities And Social Sciences :

The importance of Sanskritic studies to Humanities—literature, linguistics, rhetorics, grammar, music, dance, history, philosophy, logic etc.—is clear as sun-shine.

Most of the prominent languages of India—whether developed from Sanskrit or not—look forward to Sanskrit for literary ideas and imageries. Especially for vocabulary, all these languages are bound to depend upon the treasure of Sanskrit. Of all the languages of the world, Sanskrit possesses the largest word-stock, having, in addition to the big compounds, not less than two lacs of words. The richness of the word-stock of this language can be imagined from the simple fact that in it we have 27 synonyms for 'earth', 16 for 'sky', 27 for 'water', 15 for 'sea', 20 for 'moon', 37 for 'sun', 34 for 'fire', 16 for 'lotus', 20 for 'air' and so no. Sanskrit possesses varied words to such an extent that one is sure to get just the required word for the expression of any idea, event or sentiment. With this vast word-stock, Sanskrit can fulfil the requirements of any of the Indian languages. The greatest power of Sanskrit is that it can help us coin any word of our choice. Accordingly, for the coinage of synonyms for the technical terms of science and technology, Sanskrit is the only resort. In the same way, Sanskrit, being the source of most of the languages, is a 'must' for the study of linguistics. Particularly, philology or historical grammar of any Indian language cannot proceed even a step without banking upon

Sanskrit.

The sciences of rhetorics and grammar have nowhere in the world been dealt with in such detail and in such varied ways as in Sanskrit. And for having a strong footing in these subjects in any Indian language, the learners are bound to take the help of Sanskrit. For most of the ideas of rhetorics in the modern Indian languages have been borrowed from Sanskrit, and almost all the grammatical principles thereof are guided by Sanskrit grammar. For the sciences of music and dance also, Sanskrit is the source-treasure, as it is Sanskrit that supplies all the *suras* or tunes and *tālas* or musical beats of Indian classical music and dance.

The long history of the people of India — embracing the cultural, religious, political or social conditions, the ups and downs of the people, the geneology of the royal families or of the religious leaders — has been kept recorded in Sanskrit literature : the *Vedas, Brāhmaṇas*, epics, *Purānas, Smṛtis* etc. So, for the study of India's past, particulary its ancient period, it is only Sanskrit that can give us the necessary materials.

Ancient Indian studies in philosophy and religion were so vast, deep and varied that our words fail to evaluate them. To speak in short, India is pre-eminently a land of philosophy and religion, and the whole human race is bound to look forward to this land for these branches of study. There are no fewer than twenty principal schools of philosophy and no fewer than fifteen principal schools of religion each connected with one or other system of philosophy. And in almost all these systems of philosophy and religion, common philosophical problems like

the Absolute, God, the self, the nature of the world, causality, substance-quality, time, space, evolution etc. have been discussed in great detail and minuteness. But it is a matter of deep regret that in our educational curriculum of philosophy, Indian philosophy occupies an insignificant part—say, one-eighth or one-tenth of the entire course.

Like philosophy, logic also has a long and vast tradition. Topics like various kinds of meanings of sentences, valid knowledge with its different types, false-knowledge and its varieties, different kinds of inferences with fallacies of inferences, hypothesis, observation, experiment, the nature of cause, and so on have been discussed with all thoroughness and depth in Indian philosophies. Discourses on the problem of false knowledge and fallacies of inferences, in particular, are matchless. But in the syllabus of logic for collegiate education, Indian logic as such has hardly any place. May we not hold that disrespect to our heritage is the only reason for this negligence to Indian philosophy and logic ?

Social and normative sciences, such as, ethics, political science, economics etc. are subjects of common interest of all men of all ages. For the study of these subjects, our learners are made to look forward to the West . But have our policy-makers ever thought that in our India there were so many kingdoms with innumerable lines of kings who successfully ruled over the people like fathers and guardians ? Had not these kings any idea of ethics or politics or economics ? Certainly, they had The *Rāmāyaṇa*, the *Mahābhārata*— particularly its Śānti-parvan, the *Paurāṇic* literature, the *Smṛti*

literature, *Artha-śāstra, Kāmandakiya-nitisāra, Pañcatantra, Hitopadeśa* etc. bear testimony to the prevalence of these sciences in India. But we care them little. For our major premise is ; whatever is Indian is bad and whatever is Western is good.

B. IMPORTANCE IN THE FIELDS OF NATURAL, PURE AND EXACT SCIENCES :

Astronomy :

The contribution of ancient India to the field of astronomy is immeasurable. There were minute calculations of astronomical events even during the period of the *Vedic Saṁhitās* (circa 4000 B.C.). The *Taittiriya-Saṁhitā* of the *Yajur-Veda* refers to as many as 27 gallaxies of stars, and the *Taittirtya Brāhmaṇa* gives a list of 25 stars. In the *Ṛg-Veda,* Sūrya (the sun) is described as the soul of both the mobile and the stable. The Vedic conception that Sūrya is the fundamental divinity from whom all the earthly and atmospheric gods emanated contains the idea that the earth is produced from the sun. In the *Ṛg-Veda,* Sūrya is described as riding on a chariot drawn by seven horses (sapta aśvāḥ), which clearly refers to the seven colours of the sun-rays. Prof. Ludwig is of the view that according to the *Ṛg-Vedic* sages, the solar eclipse occurs when the moon comes between the sun and the earth. (cf. *Ṛg-Veda* 4.28.2-3). The *Kauṣitaki Brāhmaṇa* says that the northward movement (*uttarāyaṇa*) and the southward movement (*dakṣiṇāyana*) of the sun begin from the winter solstice and the summer solstice, respectively. That the moon gets its light from the sun was known to the *Ṛg-*

Vedic sages (cf. *Ṛg-Veda*, 9.71.9; 9.76.4; 9.86.32). Some hold that to the *Ṛg-Vedic* sages, the earth was known to be spherical and to be floating on the vacuum (*vide* Macdonell's *Vedic Mythology* p. 9 and *Ṛg-Veda*, 10.89.121). The *Śatapatha-Brāhmaṇa* (before 1000 B.C.) clearly describes the earth as *parimaṇḍala* or round (*parimaṇḍala u vā ayaṁ pṛthivī-lokaḥ* —*Śatapatha* 7.1.1.37). According to Prof. Ludwig, the *Ṛg-Vedic* sages knew that the earth moves round the sun and that the change of seasons is due to this rotation of the earth. There are numbers of myths in the *Vedic* literature which have now been explained as having astronomical significances. After the *Vedic* period, a distinct branch of study called *jyotiṣa* develoved, and in a still later period, a class of astronomical literature called *siddhānta* came into being. We get references to about 20 *siddhānta*-works.

That the earth is revolving on its axis was discovered first by Āryabhaṭṭa (5th century A.D.) long before Copernicus (15th century A.D.) who is generally thought to be the discoverer of this event. That the solar eclipse occurs when the moon comes between the earth and the sun and the lunar eclipse, when the earth comes between the sun and the moon was also first discovered by Āryabhaṭṭa and not by Copernicus. Vaśiṣṭha calculated the measure of a year to be 365.2591 days, while Āryabhaṭṭa has shown it to be 365.2586805 days which is said to be more accurate than Ptolemy's calculation of 365.2631579 days. Brahmagupta (6th-7th centuries A.D.) discovered the correct equations of the parallax of longitude and latitude. Long before Newton (17th-18th centuries A.D.),

Bhāskarācārya (11th century A D.) knew about the gravitation of the earth, as he said that the earth attracts everything towards itself (ākṛṣṭi-śaktiś ca mahi ..... ākṛsyate tat patatıva bhāti—*Goladhyāya*, 2.6). In the *Purāṇas*, time has been divided into human year, divine year (360 human years) etc., the four *mahāyugas—satya* (1728000 years), *tretā* (1296000 years) *dvāpara* (864000 years,) kali (432000 years — *manvantara* (36672000 years), the day of Brahmā (4320000,000 years = 4 *mahāyugas* × 1000 = 14 *manvantaras* + transition periods — *sandhyās* — of *manvantaras*), the night of Brahmā and so on. All these refer to astronomical events and periods. [The division of the history of mankind into four *yugas* has been made from another point of view, where the lengths of the *yugas* differ from those of the astronomical *mahāyugas*]. A proper calculation of these periods is expected to give us an idea about the time of the origin of the wor.d and also of the annihilation of the same. The distinction made by the Vedāntins between the *naimittika pralaya* or destruction of the *sthūla* or gross world and *prākṛtika pralaya* or the great destruction of the *sūkṣma* or fine world may be cons.dered from the astronomical point of view.

Astronomical events were accurately calculated by the astronomers of ancient India, and even now the method of their calculation gives us correct information about astronomical events. It has recently been cla:med by some astronomer (see The Sentinel, 14 May, '88) that earthquake can successfully be. predicted with the method of astronomical calculations found in Indian *śāstras*. Indian astronomy prescribes certain

restrictions on men during the time of eclipse. Modern scientists have now realised the necessity of these restrictions and have started prescribing the same. Further, our *śāstras* prohibit the taking of some particular kinds of vegetable on some particular *tithis* or lunar days or in some particular months. It has now been proved that on those days or months some microscopic germs grow, and as soon as those days or months pass off, the germs also vanish. *Śāstric* restrictions on behaviours, such as, physical labour, sex-behaviour etc. on particular *tithis* also have been proved to be scientific. We are optimistic that hundreds of such astronomical truths may be revealed by a proper or scientific pursuit of our *śāstras*.

Mathematics

In mathematics, the ancient Hindus surpassed all other nations. All the branches of mathematics—geometry, arithmetic, algebra and trigonometry developed in India long before Christ.

a) Centuries before Euclid (3rd century B.C.) and Pythagoras (6th century B.C.), the so-called originators of the science of geometry, this science was discussed in detail in Indian *Śulva-sūtras* of which Baudhāyana's *Śūlva-sūtra* (9th-6th centuries B.C.) deserves to be mentioned first. The geometrical principles discussed in this *Śulva-sūtra* were already made use of in the *Śatapatha Brāhmaṇa* (before 1000 B.C.). Kātyāyana's *sūtra* (9th-6th B.C.) showed the process of forming a square. Systems of measuring the area and volume of a circle, cone etc. were also developed by that time. In later years, Āryabhaṭṭa (5th century A.D.) discussed in detail the properties of circles, triangles etc.

b) The ancient Indian mathematics has now become a wonder to the world of mathematics. It has been found that with the help of the *Vedic* formulas, mathematical calculations can be done as swiftly and correctly as by a modern calculator. The *Vedic* mathematicians could count upto *parārdha* (= hundred thousand million million). They discovered formulas also for adding different numbers. The process of decimal notation was first invented in India just after the *Vedic* age and was popular after the 4th century A.D. In later times, *Āryabhaṭṭa* invented the processes of finding the squire-root and the cube-root witht the help of this decimal system. Brahmagupta (6th-7th centuries A.D.) dealt thoroughly with the use of zero in mathematics. The Arabians learnt these systems of mathematics from India and popularised it in Europe only in the 12th century A.D. Before that, this system was not known to the European thinkers including the Greeks.

c) The basic principle's of algebra also were known to Āryabhaṭṭa (5th century A.D.), Brahmagupta (6th-7th centuries A.D.) and others. In their writings, we find the processes of (i) representing an unknown number by some letter, (ii) multiplying and dividing the positive and negative numbers, (iii) the use of power (e.g., X^2, X^3, X^4 etc.), (iv) equation, and so on.

d) During the 3rd and the 4th centuries A.D , the Indians used in trigonometry the system of sine which was not known to the Greeks. The Indians discovered also the functions of sine, and cosine and prepared a table for the same. In *Sūrya-siddhānta* (before the 4th century A.D.), we find the

table of sines. The mechanism of calculus was also known to Āryabhaṭa and other Indian mathematicians 1500 years before Leibniz and Newton (17th-18th centuries A.D.), the so-called inventors of this system. Besides these, other important materials of the science of mathematics are found in the works of Bhāskarācārya, Mañjula and others.

Botany

Though the study on plant-life was initiated in the West by Theophrastus (4th-3rd centuries B.C.), actual studies in the formation of the body of the plant started in the 16th century A.D. In India, such studies are found in the early works like the *Ṛg-Veda* (1.32 5), the *Atharva-Veda* (8.7.12-27, 10 7 38), the *Taittirīya-Saṁhitā* (2 5.3.5; 8.3.15.1), the *Vājasaneyi-Saṁhitā* (22.28), the *Bṛhadāraṇyaka-Upaniṣad* (234.28.1; 236 30 3) etc. The system of supplying manure to the plants for their nourishment was known to the *Vedic* people (*Ṛg-Veda* 1.161.10; *Atharva-Veda*, 3.3 4, 19.31.3; 12.4 9, *Taittirīya-Saṁhitā* 7.1.19.3). That the plants prepare their food with the help of the sun-rays is hinted in the *Ṛg-Veda* (8.43.9; 2.1.14). The *Bṛhadāraṇyaka Upaniṣad* (234.28.1; 25.29.2) says that the leaves of the plants act just like the pores of the human skin. The *Mahābhārata* (Śānt parvan, 184) gives a clear description of the preparation of food by the plants. There are detailed discussions on plant-life in the *Purāṇas* and the works of Nyāya, Jainism and Āyurveda. That the science of plant-life was fully known to the Indians before the Christian era is evidenced by the work *Vṛkṣāyurveda* compiled by Parāśara.

Hundreds of years before Christ, Manu discovered that

plants are endowed with consciousness and feeling of pleasure and pain (*antaḥ-saṁjñā bhavanty-ete sukha-duḥkha-samanvitāḥ- Manu-Smṛti*). In the *Mahābhārata*, the *Bhāgavata Purāna* and other works, it has repeatedly been said that plants are endowed with life. The *Mahābhārata* accepts the presence of consciousness also in the plants, when it says that plants are sensitive to heat and cold, to the sound of thunder and to odours — pleasant and unpleasant (*Śānti-parvan*). In *Bhānumatī*, a comt. On *Suśrutā-Saṁhitā*, Cakrapāṇi (11th century A.D.) holds that the consciousness of the plants is enveloped with darkness (*vṛkṣāstu cetanāvanto'pi tamas-channatayā*). Udayana (10th century A.D.) also holds that the consciousness of the plants is extremely dull (*atimandāntaḥ-saṁjñitayā*).

Dharmottara (9th century A.D.) in his *Nyāya-bindu-ṭikā* notes that in certain trees the phenomenon of sleep is found in the form of the contraction of the leaves (*patra-saṁkoca-lakṣanaḥ svāpaḥ*). In *Kiraṇāvalī*, Udayana (10th century A.D.) says that plants have the phenomena of life, death, sleep, waking, disease, drugging, transmission of specific characters by means of ova, movement towards what is favourable and keeping away from what is unfavourable. Gunaratna (14th century A.D.) in his commentary on *ṣad-darśana-samuccaya* mentions the following characteristics of plant-life — 1) stages of infancy, youth and old age, 2) regular growth, 3) various kinds of movements and actions in the form of sleep, waking, expansion and contraction in response to touch, 4) withering on wound or laceration of organs, 5) assimilation of food according to the nature of soil, 6) disease, 7) recovery from

diseases or wounds by the application of drugs, 8) special food favourable to impregnation, and so on. He, further, gives a list of plants that exhibit the phenomena of sleep and waking and sensitiveness to touch.

Varāhamihira (5th-6th centuries A.D.) established a relation between plants and ground-water hydrology. While modern scientists depend on costly equipments and satellite-pictures to detect ground-water, one can easily do so on the basis of the nature of some plants listed by Varāhamihira in his *Bṛhat-Saṁhitā*, as has been demonstrated by some Indian geologist (see *The Assam Tribune*, 19 April, 1988).

Physiology and Biology :

Anatomy was studied during the time of the *Atharva-Veda* (10.2) and the *Śatapatha-Brāhmaṇa* (10.5.4.12 ; 12.3.2.3). The *Suśruta-Saṁhitā*, the *Caraka-Saṁhitā* the commentaries on them and many other works deal in detail with physiology and biology. The topics discussed in these works are : the elements of the body, the digestive system, the circulatory system, the nervous system, the *cakra* (nerve-centre)-system in the spinal cord, the activities and positions of *vāyu* or vital air in human body, foetal development, heredity, sex-problem, life and so on.

The principal elements of the body are three in number, namely, *vāyu* or the vital air, *pitta* or fluid animal heat flowing in all the parts of the body and *kapha* or lymph. The digestive system discusses how our food is digested through the co-action of different vital airs, the digestive fluid and so on, and how the fine essence of our food is trans-

formed into different elements of the body blood, flesh, bone and so on. The circulatory system deals with the process of blood-circulation throughout the body. The nervous system discusses the positions and activities of the nerves which are of three kinds — *śirās* or cords, *dhamanis* or fibres and *srotas* or currents. A peculiarity of Indian physiology lies in the acceptance of the *srotas*. It is held that the chyle, blood, vital air, metabolic fluid (*pitta*), lymph, fat, marrow and all other elements existing in any part of the body are connected by subtle currents or *srotas* with the same kind of elements existing in other parts. It is argued that without supposing such currents or connections many pathological phenomena could not be explained. The *śirās* are said to conduct or transmit blood, lymph, bile and vital air from one part to another of the body. Of the *dhamanis*, some are meant for conducting sensory currents to the heart which is the seat of consciousness; some, for conducting automatic or voluntary motor-currents (e.g. currents relating to respiration, yawning, sleeping, waking etc.) or the secretions of the glands ; some, for conducting chyle and venous blood ; and some, for conducting *vāyu*, *pitta* and *kapha*. Caraka gives the number of *śirās* as 700 and that of *dhamanis* as 200. He further gives the number of ramifications as 3, 056, 900.

The system of *cakras* or plexuses in the spinal cord, on which the whole of the Hindu idea of spiritual progress of a *sādhaka* hinges, is a wonder to human thought. It is held that through the spinal cord there runs a very fine nerve called *suṣumnā*, and to both the sides of *suṣumnā* two other nerves called *iḍā* and

piṅgalā exist. In the nerve *suṣumnā* there are some nerve-centres called *padmas* or lotuses connected with different psychological dispositions. To all the spiritualists of India, the exixtence of these *cakras* is beyond any doubt. But Western science has not yet realised the truth of this system of *cakras*. Of course, some Western scientists have now found some clue to this system, but deeper research is still awaited in this matter.

Forty-nine *vāyus* or vital airs are said to work in the human body. Of them the chief ten *vāyus* are : the well-known five *prāṇas* plus *nāga*, *kūrma*, *krkara*, *devadatta* and *dhanañjaya*. The foetal development, the problems of heredity, sex and life and other matters have been discussed in detail in the works of Caraka and Suśruta. In the view of Caraka, the foetus is composed of sixteen organic substances All these matters are yet to be verified by scientific research.

Medical Science

Āyurveda of India is the oldest medical science of the world. The *Rg-Veda* mentions the curative powers of the herbs (10.97). The *Atharva-Veda* also discusses the symptoms of diseases along with the corresponding medicines. Though the practice of surgery was faintly known to the Greeks of the 5th-6th centuries B.C., it came to be introduced in the Western medical science only in the 18th century A.D. On the other hand, this science was known to India during the period of the *Atharva-Veda* (before 3000 B.C.). Suśruta has dealt at length with the method of surgery. Jivaka (5th century B.C.) was an expert in surgery. He could operate the intestine and

brain, and stitch the skin. The use of mercury and iron in medicine was known to India during the beginning of the Christian era, while in Europe it came to be introduced only in the 16th century AD. Discourses on Āyurveda are found in the *Purāṇas* and many other works of which the *Saṁhitās* of Suśruta II and Caraka II, both belonging to the 1st-2nd centuries A.D.,* are most important. Researches on herbs from the view-point of medical science were so extensive that Jivaka, asked by his teacher Ātreya could not find out any herb having no medicinal value. The Āyurveda of India was learnt by the Arabians before the 9th century A.D., as is proved by the fact that the *Caraka Saṁhitā* was translated into Persian and Arabic in the 8th century A.D.

The importance of Āyurveda lies in the emphasis it lays on *dravyaguna* or the qualities of things of our day-to-day use. Indian tradition gives great importance to the leaves of *tulasi* and *vilva*, the secret being that these have got medicinal values. The leaf of *tulasi*-plant, in particular, is a cure for fever, cold and cough, and is an antidote to malaria. Cow-dung is used to cleanse the floors and to pluster the fences of houses, because it destroys the germs of diseases and absorbs the harmful rays of the sun or the moon during eclipses. The greatest merit of Āyurveda is that here medicine is just like a form of diet, as it is prepared directly from herbs, leaves, metal and other things, and, as such, brings no re-action or side-effect to the users.

Of the different branches of Yoga, Haṭhayoga is regarded

* Caraka I and Suśruta I belonged to the 14th century B.C

by the Yogins as a system of medical science, as it helps us keep perfect health and increase longevity. Matsyendranātha and Gorakṣanātha (8th-11th centuries A.D.) were well-known exponents of this science. The Buddha and his disciples also were experts in Yoga. This Yoga is a wonder to human civilisation as it helps men curing both mental and physical diseases, simply through some physical practices. This practice can bring about a complete change in the body and the nervous system. By Yogic practices, man can float on water, fly in the sky and even go out of the sight of others. Trailanga Swami and Pawhari Baba of the last century, Vijnanananda and Swami Yogananda of this century, and numerous other saints are shining examples of all this. The *Pauraṇic* and epic descriptions that the Asuras could fly from one place to another, that Indrajit and others could fight from the sky, and that Hanumat jumped across the sea can very well be explained from the Yogic point of view. The modern world has now started realising the tremendous power of Yoga.

Physics :

Long before the birth of Buddha (6th century B.C.), the *Upaniṣads*, the Vedānta philosophy and the Sāṁkhya philosophy developed elaborate theories about the nature of the material objects. During the period from the 4th to the 2nd centuries B.C., the Jainas and the Naiyāyikas propounded different theories of physics. The theory of atom, in particular, was elaborately dealt with in the schools of Nyāya-Vaiśeṣika, Sāṁkhya and Vedānta.

The Nyāya-Vaiśeṣikas hold that there are four kinds of *paramāṇus* or atoms — earth, water, fire and air. In their view, during the time of creation, two atoms of the same class joined together form one *dvyaṇuka* or dyad, three *dvyaṇukas* form one *tryaṇuka* or triad, four *tryaṇukas* form one *caturaṇuka* or *quadriad*, and so on, ultimately forming the vast world. They have explained also in detail how qualities of things change by the application of heat, and how the *parispanda* or subtle motion of the atoms and molecules takes place. The Sāṁkhyists say that *prakṛti*, an all-pervasive fine reality, is the cause of the world. *Prakṛti* consists of three elements called *guṇas*, namely, *sattva*, *rajas* and *tamas*. All the objects of the world — the mind, the sense-organs and the material objects — are evolved from this *prakṛti*. According to Sāṁkhya, atoms are not the ultimate realities; they derive their existence from some finer elements called *tanmātras* which on their part evolve from *prakṛti*. An analysis of the nature of *prakṛti* shows that it is nothing but universal energy, and the three *guṇas* of it correspond more or less to electron, proton and neutron of modern science. The Advaita-Vedāntins derive the material world from *māyā*, a power of God. In their view, *māyā* gives rise to the subtle elements of *ākāśa* (ether ?) air, fire, water and earth, in succession, after which these elements get intermixed and form different kinds of atoms Thus, in this view, each atom is a peculiar ultra-chemical compound of the five original subtle elements. The Grammarians derive all the elements of the world from *śabda* or sound. The point is

that *śabda* is a quality of *ākāśa* and that, in the ultimate analysis, reality is neither a substance nor a quality, but a synthesis of both. Hence, from the highest point of view, *śabda* and *ākāśa* form a synthetic reality. The Tāntrikas — the Śaivities and the Śāktists — go still further and say that all the objects of the world evolve from Śakti or Universal Power of the nature of consciousness. All these systems believe in *mahāpralaya* or universal annihilation during which all the objects of the world are said to go back to the original cause. Further, most of these systems, particularly the systems of Sāṁkhya and Tantra, hold that no new matter or energy is ever created, and no matter or energy is ever destroyed. These theories of the conservation of matter and energy were well-known to India centuries before the birth of Christ, while the West came to know about these theories only a few centuries back.

Dr P.C. Roy holds that to Kaṇāda (4th century B.C.) and Kapila (before the 5th century B.C.) heat and light were known to be but two manifestations of the same energy. Besides, the ancient Hindus knew about the reflection and refraction of light, chemical effects of light, burning of things through the focus of the sun-rays, magnetic attraction, and so on.

Chemistry :

During the first few centuries of the Christian era, elaborate theories of inorganic compounds were known to the Indians. References to various kinds of salt — common salt, salt-petre, earth-salt — are found in the works of Caraka and

Suśruta. In *Suśruta Saṁhitā*, we find the description of the preparation of metalic salt also. Some thinkers of that time were of the view that precious stones are but rocks or earth-substances metamorphosed by natural process in the course of ages (ratnarūpatvaṁ prāptāḥ kālāntareṇa — Utpala on *Bṛhat-Saṁhitā*.

The preparations of chemical compounds were known to the schools of Caraka and Suśruta. In the treatise on *loha-śāstra* or metallurgy, Patañjali has dealt elaborately with many metallurgical and chemical processes, specially with the preparations of metalic salt, alloy and amalgam, and also with the processes of extraction, purification and assaying of metal. Nāgārjuna has discussed the process of the preparation of mercury. In *Bṛhat-Saṁhitā*, Varāhamihira (6th century A. D.) has given several processes of preparing cement or powder called *vajralepa*. He refers also to the experts in the preparation of dyes and cosmetics. During the middle ages, India earned fame abroad for the preparation of dyes for textile fabrics, for the principle of extraction of indigotin from the indigo-plant, for the production of high class glass and for the tempering of steel. Processes of chemical composition and decomposition and other metallurgical processes we very often come across in the said works and others are : extraction, purification, calcination, incineration, powdering, solution, distillation sublimation, precipitation, rinsing, drying, steaming, fixation, melting, casting, filing and so on. All these were done by the use of apparatus and reagents and by the application of heat. Ideas of the

formation of molecular qualities in chemical compounds are also found. In the view of Caraka, the colours, tastes and other qualifies of the molecules of chemical compounds get their rise from the different proportions in the collocations of the atoms and from the actions of the different forces latent in them.

Warfare : Air-Craft

The descriptions of fighting with arrows and other weapons found in the *Rāmāyaṇa* and the *Mahābhārata*, if properly analised, are expected to give some ideas about the development of the science of warfare during those days. Special mention may be made in this connection to the Śabda-vedhī arrow — an arrow that could hit a target by pursuing its sound — which could be used by Daśaratha, the Śaktiśel used by Indrajit to kill Lakṣmaṇa, the Brahmāstra used by Rāma to kill Rāvaṇa, the Nāgapāśa-arrow used by Indrajit to bind Rāma and Lakṣmaṇa, the Pāśupata-arrow which could be used only by Śiva, the Sudarśana-cakra which could be used only by Śrikṛṣṇa, the Nārāyaṇa-astra used by Aśvatthāman, the Brahmaśira-astra used by Aśvatthāman to kill the embryo of Uttarā, and such other arrows and weapons. Some notable features in the application of these arrows and weapons are : (i) an arrow was meant to hit only a particular target, (ii) a weapon would come back to the user after hitting the target and (iii) an arrow could be rendered ineffective by an arrow of opposite power e.g. a fire-arrow, by a rain-arrow. These descriptions naturally call forth questions whether the said weapons were some sorts of atomic missile actually in use, or whether they were but scientific fictions. And it is the task of the scientists

of our country to carry on research in this direction and ascertain the real nature of those weapons.

There are reference to air-flights in the *Ṛg Veda*, the *Rāmāyaṇa*, the *Mahābhārata* etc. The Puṣpaka-ratha of Kuvera is well-known. It is said that Rāma flew back from Laṅkā to Ayodhyā in a short time by this chariot. In the description of Arjuna's journey to the land of Indra, found in the *Mahābhārata*, we get a vivid picture of air-crafts — some standing, some landing, and some going to take off. Further, a work entitled *Vaimānika-śāstra* ascribed to Bharadvāja deals at length with the technique of making aircrafts and the materials used theirin. From all this, we are inclined to think that air-craft was known to ancient India. Proper scientific research, however, is awaited for coming to a definite conclusion in this regard.

A story which described some Sānudāsa jumping from the peack of a hill by holding an open umbrella (see R.C. Majumdar, *Prācin-bhārate Vijñān-carcā*, p.45) hints that the use of someting like modern parachute was known to the ancient Indians.

This short outline will give an idea about the unsurpassed achievements of ancient India in different fields of science and humanities. Records of these achievements of ancient India are all to be found in Sanskrit literature. It is highly probable that innumerable materials relating to science, in particular, are lying hidden in this literature, which are yet to be scientifically proved and demonstrated. And for this purpose, it is imperative to undertake extensive and intensive studies in the original Sanskrit texts.

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It is refreshing to note that in a situation when the New National Education Policy, 1986, has promised to extend patronage to Sanskrit and other Classical Languages so that young learners can delve into the source of Indian Culture and can at the same time feel pride for the richness of our national heritage, Dr. Kali Prasad Sinha has come forward with his small book entitled 'On the Need of Sanskrit'. In three Chapters the book describes the present sad state of affairs in regard to Sanskrit learning and relevance of Sanskrit to the fields of Humanistic, Scientific and Technological studies of the present day. Each Chapter is marked by new flashes of thought, and bears testimony to the author's deep penetration into original Sanskrit texts covering the fields of Literature and Philosophy, Religion and Science, Technology and Architecture.

The book records the thoughts of a profound Sanskrit scholar on the necessity of preserving Sanskrit, which not only is the gateway to Indian Culture, but which at the same time is the means of communicating scientific and technological knowledge generated in the morning of mankind. The book is sure to attract the attention of the Oriental scholar, who is eager to know the relevance of Sanskrit to modern society. It will also prove itself interesting to the common reader, who is keen to have a glimpse of his grand heritage.

—PROFESSOR RAMARANJAN MUKHERJI,
CALCUTTA

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